# FNAL Overview


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# Overview of FNAL as a facility.

Three large computing facilities.

- Feynman Computing Center
- Grid Computing Center
- Lattice QCD Computing Center

FCC -

- STK Powderhorn, ADIC AML/2

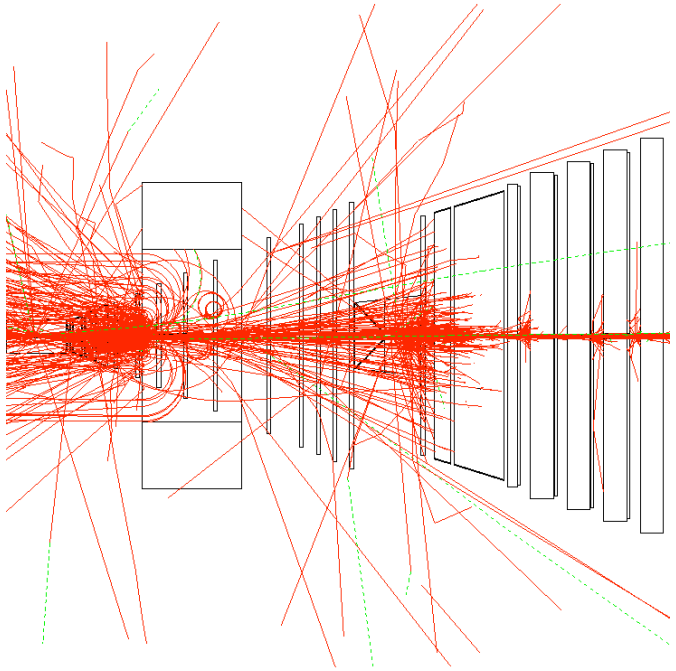
Grid Computing Center

- 2000 sq foot tape room being provided

# HEP Data basics

- Statistical Science
- Phenomina: associated with collision of two or more particles at high energy.
- These “events” are typically ~ 1 MB.
- Packaged in files for handling.

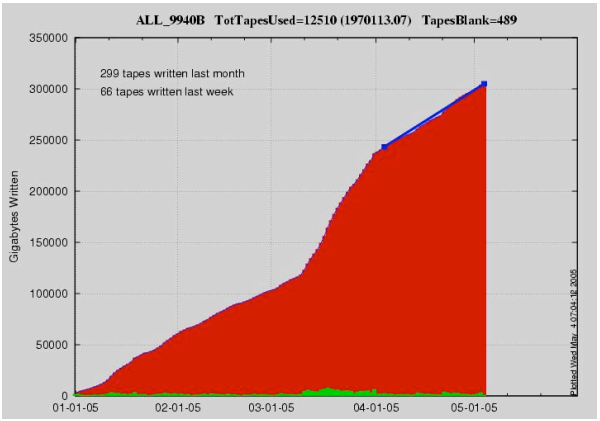
Muon triggered B events

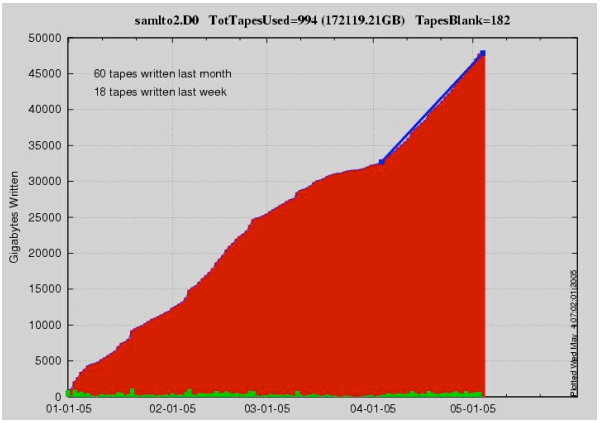


all charged tracks

# Permanent Scientific Store at FNAL

- > 2.6 Petabytes
- ~100 tape drives
- Most data are currently written on LTO2, 9940B
- Data are also on LTO1, 9940, DLT
- Sizeable increases foreseen for CDF, D0 and LHC (CMS).



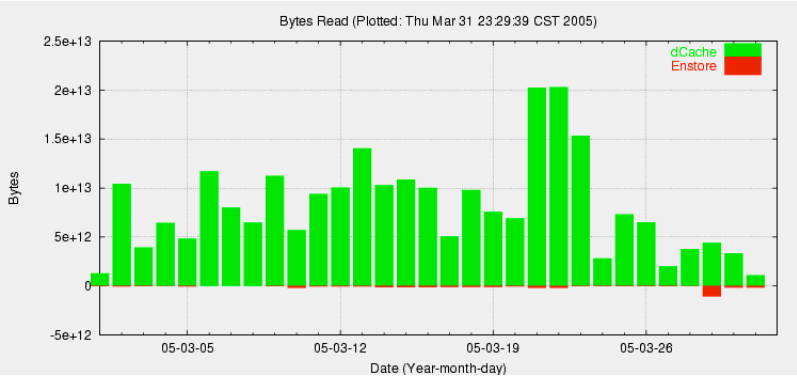



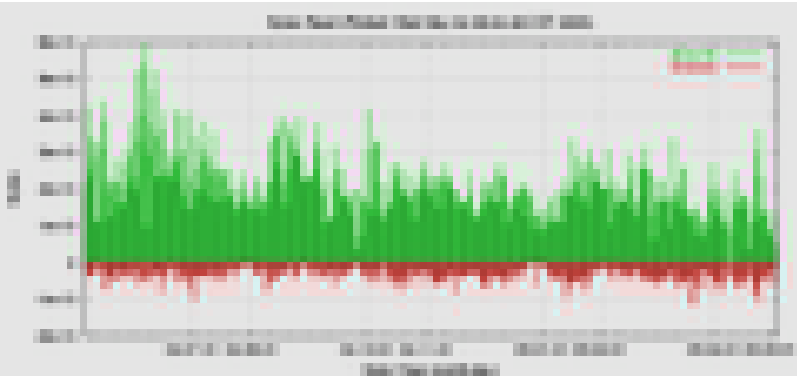
# Permanence Features

- Only one copy of the data is typically kept.
- Write protect tabs are manipulated
- CRC of file is kept as meta-data.
  - Computed at ingest.
  - Random check after write.
  - Random checking of store independent of use.
  - Check When serving files
  - Check files in SS cache.
- Separation of roles on delete.
- Tape faults investigated.

# Access Characteristics (local)

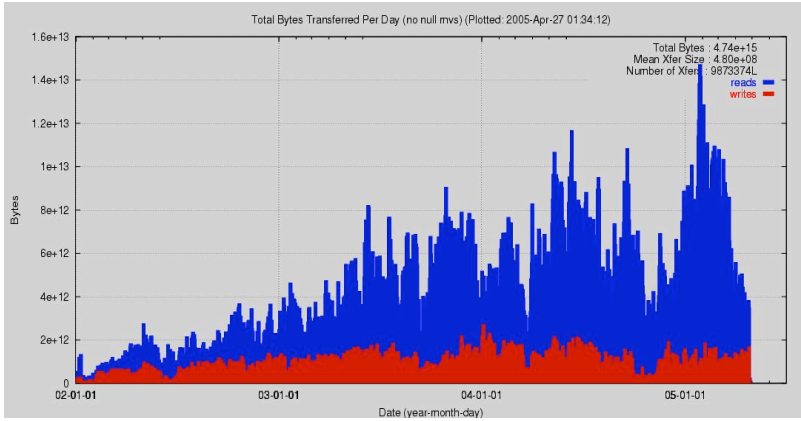
- The Store is part of an HSM.
  - Data are actively read.
  - Reads from the store outnumber writes to the store
- FNAL-written Enstore software
  - Each tape drive is connected to Linux Mover Computer, which is connected to the campus LAN.

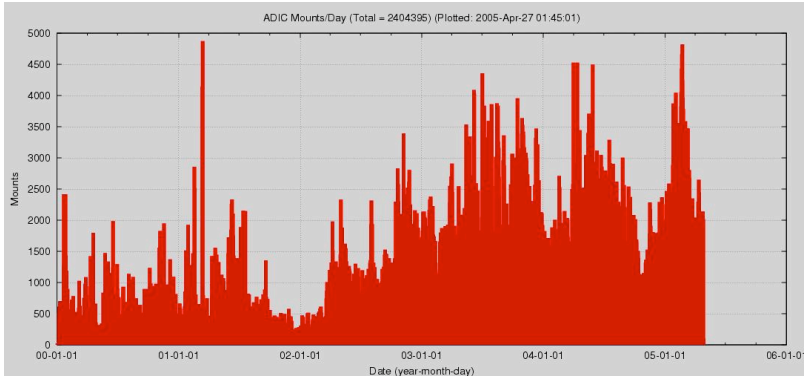


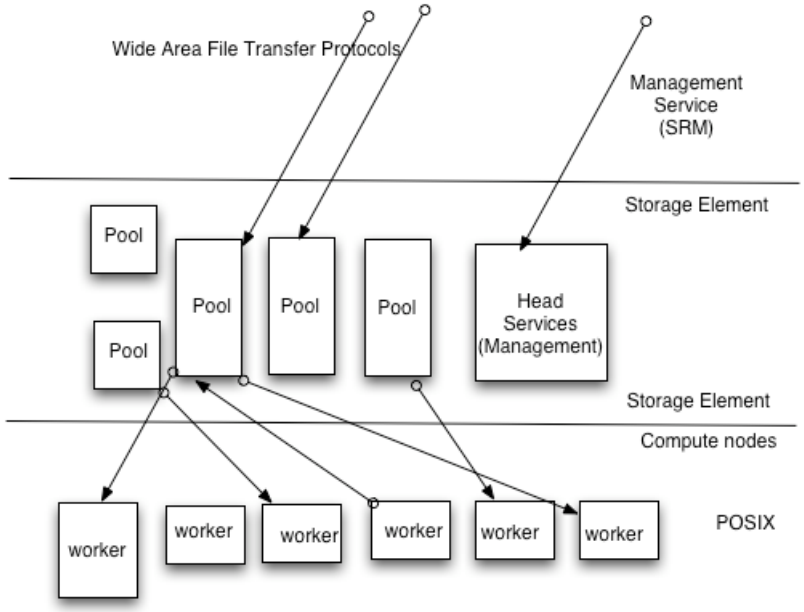
# D0 Enstore System

- Ratio of reads to writes seems to be growing.
- Many thousands of mounts each day.



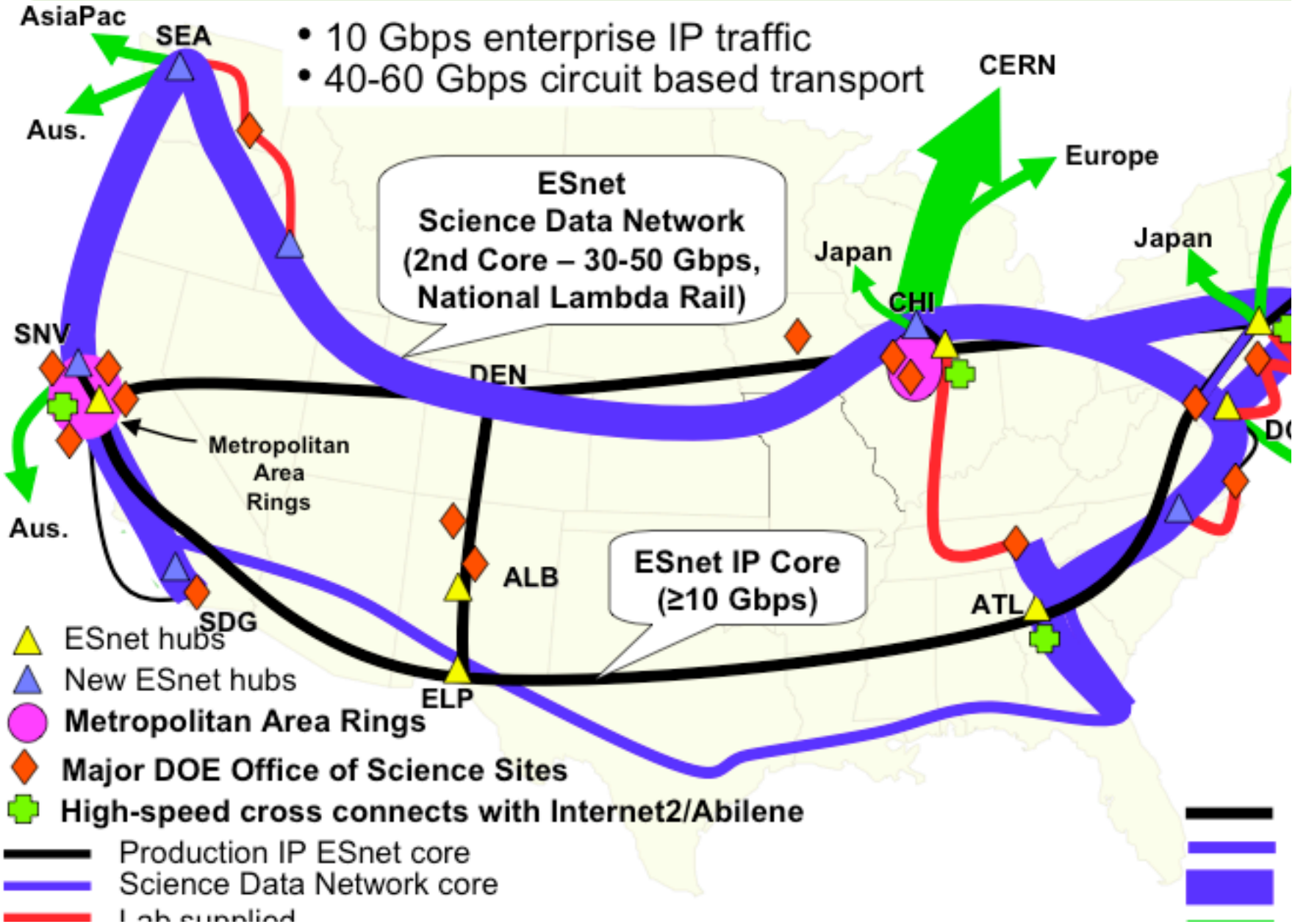



# Access Characteristics (Grid)



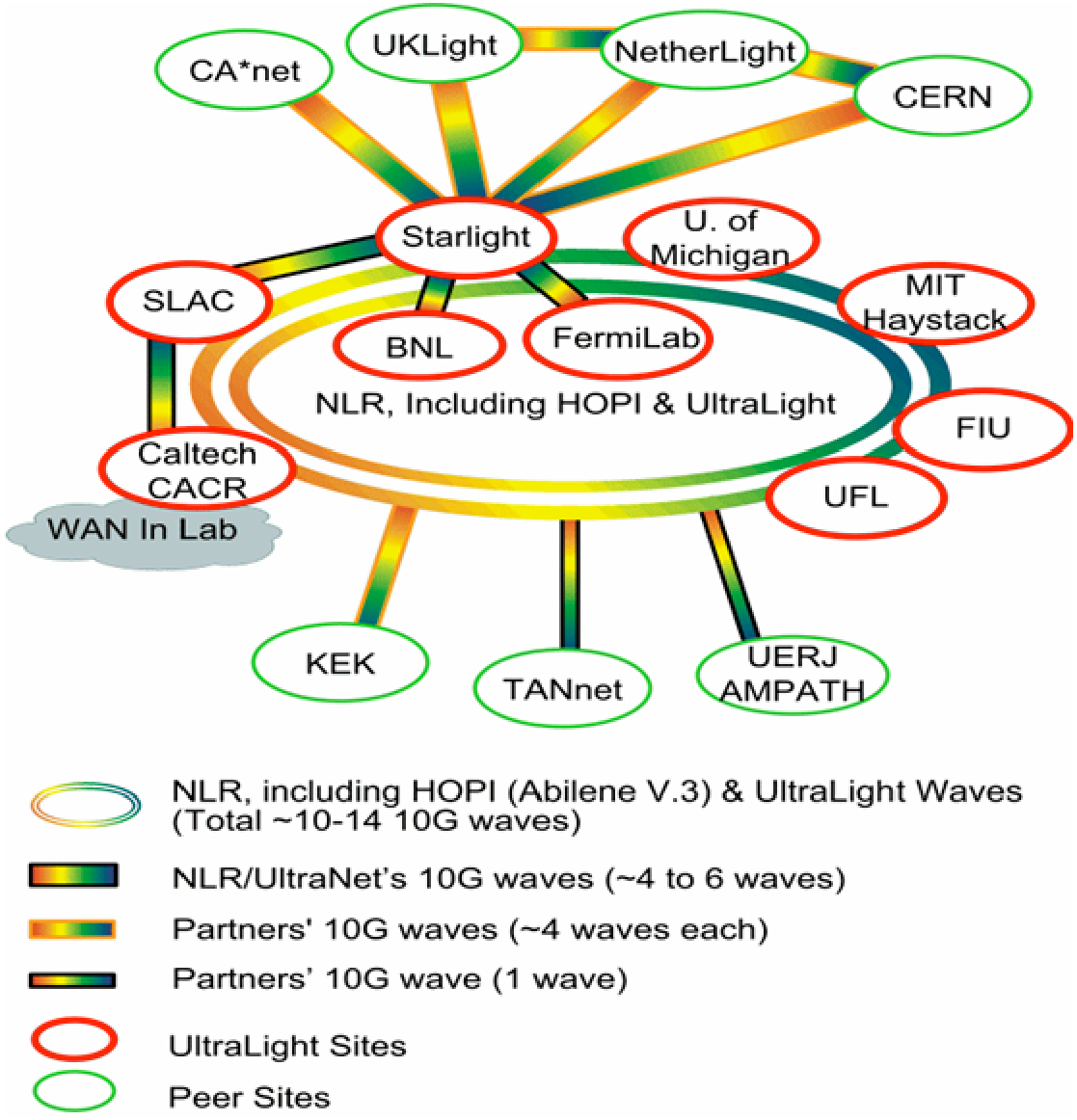

- The Tape Stores are Grid storage elements
- Taps is behind disk buffers.
- Grid architecture recognized the need for “custodial stores”

# ESnet Goal – 2007/2008



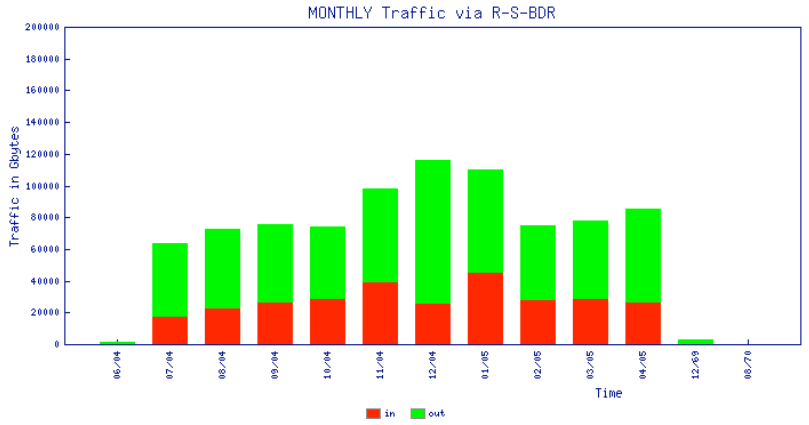
# UltraLight Network: PHASE 2

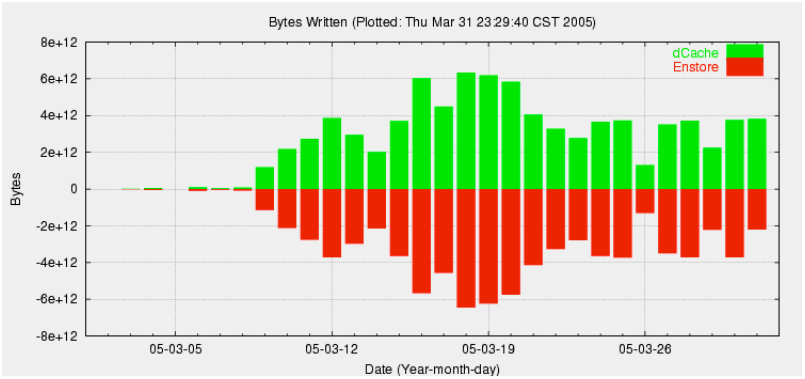
- Move into production (2007)
- Optical switching fully enabled amongst primary sites
- Integrated international infrastructure



# WAN operation Demonstrations

- 50-60 MB/sec of tape ingest Trans Atlantic, running for a month.
- 7 Gbit/sec Trans Atlantic, ingest to FNAL storage system (dCache) for a month
- Hope to show 40-50 Gbit/sec at SC



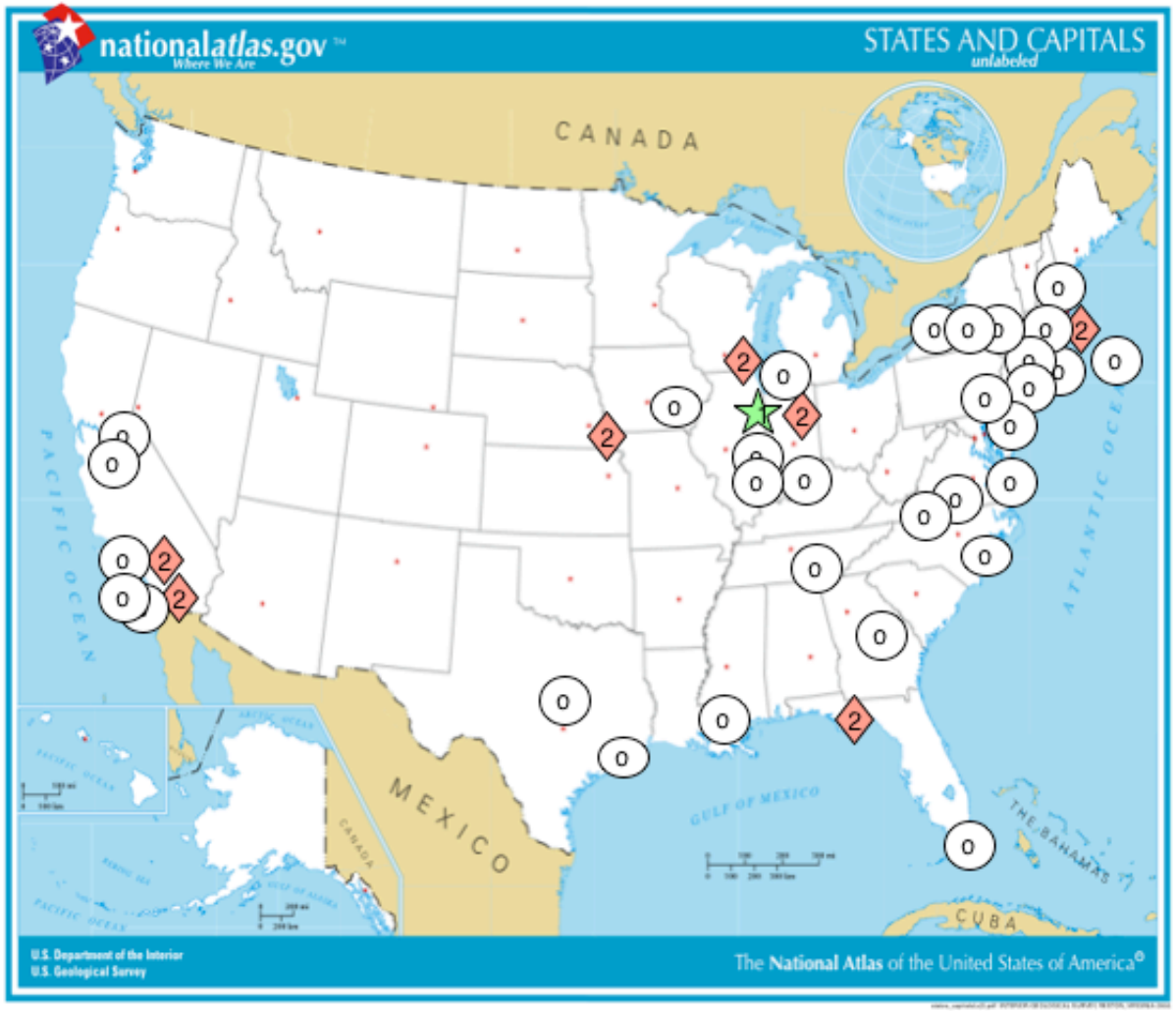
# FNAL library requirements

- Do (and seek to) have multple tape technologies
- Able to integrate many robot species.
- STK and LTO approved by stakeholders.

# Open Science Grid Consortium


- The Open Science Grid (OSG) Consortium was formed in 2004 by teams from U.S. universities and national laboratories in order to build and support a production quality peta-scale Grid infrastructure for large scale science.
- Partners with EGEE, LCG and TerraGrid.
- Non US institutions.may be partners.
  - Case under consideration is when an application bring s in non US sites.

# OSG participants



# Two Important Technical Groups

- Storage (active for a year)
- Network (just forming)
- Buffering Storage and networking are complimentary activities.


# Storage Technical Group

- The Storage Technical group is lead by Paul Sheldon (Vanderbilt) and Robert Kennedy (Fermilab).
- The main activity of the group is to deploy managed storage elements on the OSG.
  - Independently implemented, interoperating, SE are being deployed.
    - LBL DRM
    - Fermilab/DESY Dcache.
    - Interest in from the IBP people (Tennessee)


# Network Technical Group

- The Network Technical group is lead by Shawn McKee(Michigan) and Donald Petravick (Fermilab).
- We are beginning to organize.
  - Have seeded a monitoring activity.
  - Want to consider the needs of the HEP experiments exploiting OSG.


# OSG Last Tuesday


- For OSG-ITB
  - Integration Test Bed
- http://gocmon.uits.iupui.edu:8888/

# FNAL Strengths

- Data Volume
  - Hemispheric Center for LHC CMS experiment.
  - Vigorous and Important RunII program,
  - SciDAC Lattice QCD
- Engagement
  - Very well connected for world-wide data serving.
  - Leadership roles in the LHC, OSG, SciDAC,
  - Active software developer in LHC storage system.
  - Active developer for in Permanent archives.
  - Facilities
- Facilities
  - Expanding facilities, including open lab technology showcase area in Feynman Computing Center.
  - Tremendous  Global connectivity

# Enough about that

# Library Drivers

- Diverse locations for FNAL data sets.
  - New 200 sq ft space is ~1 mile away.
- Yet more data.
- End of life for AML/2.
- Powderhorn:
  - EOL issues
  - Drive diversity issues.

# Tape status

- Considerable experience with IBM LTO and STK drives.
  - Experience with both drive species is comparable.
- Stakeholders like the diverse technology approach.
- Helical Drives are viewed as needing extensive evaluation and analysis.
- Linear drives are thought to be easier to qualify.
- Active steps are needed to assure consistently good quality for open market media

# Tape Alternatives Status

- Must be considered if ATL investments are large.
- Disk:
  - Literal tape replacement
    - Possible in the enstore framework
  - Custodial raid issues
    - Positive low-level over-write protection
    - Complex, compared totally passive tape
    - May lose all files on disk failure
    - Demanding on infrastructure (floor space, etc)
- Optical:
  - "too many pieces" for petabyte scale

# Library Desiderata

- Procure units of ~5000 - ~10000 slots for production.
- Heterogeneous libraries is our current model.
- Diverse drives can be supported by diverse libraries. (Though within a library is good)
- Stakeholder expect LTO, STK support.
- Libraries should be compatible with long term roadmaps beyond what the stakeholders can see.
  - Large expenses will motivate a search for alternatives.

# FNAL Summary

- Well connected to networks and deployment of applications
- Well skilled and experienced -- permanent scientific archive is a specialized skill.
  - Leadership roles in many areas.
  - Prominent demonstrations at iGrid and SC.
- Expanding and modernizing facilities
- Wanting a  few good partners.